National Institute of Environmental Health Sciences

Climate change and heat-related mortality in six cities part 2: Climate model evaluation and projected impacts from changes in the mean and variability of temperature with climate change

Author(s): Gosling SN, McGregor GR, Lowe JA
Year: 2009
Journal: International Journal of Biometeorology. 53 (1): 31-51

Abstract:

Previous assessments of the impacts of climate change on heat-related mortality use the "delta method" to create temperature projection time series that are applied to temperature-mortality models to estimate future mortality impacts. The delta method means that climate model bias in the modelled present does not influence the temperature projection time series and impacts. However, the delta method assumes that climate change will result only in a change in the mean temperature but there is evidence that there will also be changes in the variability of temperature with climate change. The aim of this paper is to demonstrate the importance of considering changes in temperature variability with climate change in impacts assessments of future heat-related mortality. We investigate future heat-related mortality impacts in six cities (Boston, Budapest, Dallas, Lisbon, London and Sydney) by applying temperature projections from the UK Meteorological Office HadCM3 climate model to the temperature-mortality models constructed and validated in Part 1. We investigate the impacts for four cases based on various combinations of mean and variability changes in temperature with climate change. The results demonstrate that higher mortality is attributed to increases in the mean and variability of temperature with climate change rather than with the change in mean temperature alone. This has implications for interpreting existing impacts estimates that have used the delta method. We present a novel method for the creation of temperature projection time series that includes changes in the mean and variability of temperature with climate change and is not influenced by climate model bias in the modelled present. The method should be useful for future impacts assessments. Few studies consider the implications that the limitations of the climate model may have on the heat-related mortality impacts. Here, we demonstrate the importance of considering this by conducting an evaluation of the daily and extreme temperatures from HadCM3, which demonstrates that the estimates of future heat-related mortality for Dallas and Lisbon may be overestimated due to positive climate model bias. Likewise, estimates for Boston and London may be underestimated due to negative climate model bias. Finally, we briefly consider uncertainties in the impacts associated with greenhouse gas emissions and acclimatisation. The uncertainties in the mortality impacts due to different emissions scenarios of greenhouse gases in the future varied considerably by location. Allowing for acclimatisation to an extra 2 degrees C in mean temperatures reduced future heat-related mortality by approximately half that of no acclimatisation in each city.

Source: http://dx.doi.org/10.1007/s00484-008-0189-9

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A2, SRES B2

Exposure :

weather or climate related pathway by which climate change affects health

Temperature

Temperature: Extreme Heat

Geographic Feature:

resource focuses on specific type of geography

Ocean/Coastal, Urban

Geographic Location:

resource focuses on specific location

Non-United States, United States

Non-United States: Australasia, Europe

European Region/Country: European Country

Other European Country : Hungary; Portugal; United Kingdom

Health Impact:

specification of health effect or disease related to climate change exposure

Morbidity/Mortality

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Outcome Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article, Research Article

Timescale:

time period studied

Long-Term (>50 years)